SUMMARY OF RESISTANCE TRIALS ON COCONUT TO SELECT CSPWD RESISTANT VARIETIES IN GHANA.

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Introduction

- Importance of coconut in southern Ghana:
- i. ‘Main stay’ of economies of the coastal belt
- ii. Usually the only economic crop cultivatable
- iii. Due to poor soil conditions
- iv. Coconut threatened by CSPWD since 1932.
- v. CSPWD is a LY disease, caused by phytoplasma
- vi. And transmitted mostly by homopteran vectors.
- **vii. Research from 1942 to 1956 determined resistant varieties as the best control option**
- **viii. Resistance screening of varieties was thus started in 1956 and has continued to date.**
- ix. To date 21 Trials, using 49 vars have been carried out.

Introduction Contd.

x. Situational Reports already Published:

- **xi. MYDxVTT Replants: the outcome of past trials.**
- **xii. Emerging results from MYDxVTT plots.**

- **xiii.Objectives of this paper:**
- **- To review past screening trials in Ghana;**
- **- To update results of current trials;**
- **- And to discuss the prospects for future resistance trials and replantings.**

HIGHLIGHTS OF PAST TRIALS

- **The 1956/57 & 1966/69 Trials by Dept of Agric:**
- Location: Ohawu, Dzelukope, Tegbi and Cape St Paul.
- Varieties: MGD, MYD, and WAT (survivals).
- Establishment: Only the Dzelukope trial survived.
- Results: Table 1.- All test palms succumbed to CSPWD.
- Inferences:

  -CSPWD and LY not the same disease, or

  -the MGD and MYD tested were not ‘true to type’

Table 1. Disease in Dzelukope trials (1956/57)

Vars.	No. Of Palms	% Disease Level				
		Mar. 1965	Jun. 1965	Feb. 1966	Dec. 1966	Feb. 1977
MGD	10	8.3	8.3	50.0	92.0	100
MYD	24	33.3	45.8	70.8	96.0	100
WAT	33	42.4	48.5	87.8	91.0	**

**no data available.

Consequently: seednuts of all ‘colour-forms’ from ‘certified LY-resistant mother palms’ were tested at Dzelukope in 1966/69.

Results: All the Malayan Dwarfs tested highly susceptible to CSPWD.

The 1977 Trials (Cape 3 Points)

- Inferences from 1966/69 Trials:

-Adverse environmental conditions.

-Recommendations: To site trials in Western Region & to consider the Malayan Dwarfs.

After Dzelukope experience: CRI planted the trial at C3Pts in 1977.

Vars: **'certified' MRD, MYD, MGD, WAT, few Veitchia and Phoenix, and some Oil palm volunteers.**

Results: All coconuts killed by CSPWD, other palms survived. **Inference:** Malayan dwarfs succumb to CSPWD even under the relatively better environmental conditions of the Western Region.

The 1981/83 Trials.

- Planted by: Min of Agric; under France-Ghana-Ivory Coast- Coconut Project; Funded by French Govt.
- 7 sites in the Western Region planted with 27 varieties in RCBD
- Results: Table 2 summarizes status of the trials 27 yrs after planting.
- Behaviour of the disease was not same. Some Trends:
  - -Active disease throughout, no dormant period (C3Ps)
  - -Dormancy after certain active period and peak disease level (Dixcove, Agona, Axim)
  - -Akwidae had active disease from 1988 to 1990 then dormancy and active again from 1995 to 2003 then dormant again.
  - -Disappearance of disease just after first attack(Princess Town).

Table 2. Status of 1981/83 Trials as at Apr. 2008

Trial	Exposure Period Before Infection (Yrs)	Peak Disease Level Attained (%)	Current Disease Status	Active Disease Period (Yrs)	Dormant Disease Period (Yrs)
C3Pts	7	91	Active	31	Nil
Akwidae	7	66	Dormant	2 and 8	5 and 5
Dixcove	7	67	Dormant	11	9
Agona	15	65	Dormant	7	5
Princes T	14	0.3	Dormant	1	12
Dadwen	No disease	-	Free	-	-
Axim	20	83	Less Activ	6	2

Table3.Disease incidence in some varieties of the 1981/83 Trial

Vars	Disease Level (%)					All Plots		RRat
	AgJn	Akw	Axi	Dixc	C3Pt	TL	%Ds	
SGD	0	0	1	0	0	59	0.02	HR
MRD	11	0	0	57	100	45	34	LR
VTT	0	-	100	13	-	21	38	LR
EGD	72	0	33	29	100	42	47	LR
MYD	71	31	-	0	100	51	51	LS
MYD.VTT	44	-	100	25	-	22	56	LS

Vars: varieties; AgJn: Agona Junc; Akw: Akwidae; Axi: Axim; Dixc: Dixcove; C3Pt: Cape 3 Points; TL: total of Palms; %Ds: % Disease; RRat: Resistance Rating (according to scheme of Been, 1981). HR: high-ly resistant; LR: less resistant; LS: less susceptible; HS: highly susceptibl

Fig. 1. Growth Habit of Two ‘25 Year-Old’ SGD Palms

Abnormal Growth at Axim Plot:

Stunted and Vegetative only

Normal Growth at Agona Jnc:

Luxurious with good nut load

Fig.2. Growth Habit of Two ‘25 Year-Old’ VTT Palms

Abnormal Palm at Axim: Situnted and Vegetative only

Normal Palm at Agona: Luxurious and good nut load

The 1995 Trials.

- Planted by OPRI-Coconut Programme, with funding from EU (EC STD3);
- 11 varieties planted at 2 locations in the Western Region, Tumentu and Cape 3 Points
- Tumentu is still disease-free after 13 yrs
- Cape 3 Points affected after 9 yrs of exposure
- Results of Cape 3 Points trial summarized in Table 4: All the varieties have been affected by the disease
- But TACD, CATD, TAGT, PNT-02 and PNT-01being less susceptible (in that order)
- And WAT:Ex-Benin. LCT, and ADOT being highly susceptible.
- Inference: Absence of LY in Benin not due to resistant palms

Table 4. Cumulative Disease Incidence in the 1995 Trials, as at April 2008.

Var	No. of Palms		Cumulat Disease	Resist Rating
	TL	Affected	%	
LCT	49	43	87.8	HS
ADOT	43	31	72.1	LS
PNT-02	35	12	34.3	LR
TAGT	32	7	21.9	LR
EX-BENIN	56	52	92.9	HS
CATD	9	2	22.2	LR
TACD	10	1	10.0	HR
PNT-01	45	22	48.9	LR

The 2007 Trials

- The OPRI-Coconut Programme under FSP Project Funded by French Govt, planted 3 trials with 8 new introductions and 2 old ones in 2007.
- Location of trials: Cape 3 Points and Nkroful(WR) and Asebu (CR)
- Experimental Design: Computer generated complete randomized design to ensure uniform exposure.
- List varieties planted: Table 5.
- Results: trials not yet affected by CSPWD

Table 5. List of Varieties Planted in 2007 Trials

1	Malayan Green Dwarf (MGD)
2	Polynesian Red Dwarf (PRD)
3	Indonesian Brown Dwarf (IBD)
4	Niu Leka Dwarf (NLD)
5	New Guinea Brown Dwarf (NGBD)
6	Thailand Green Dwarf (TGD)
7	Cambodia Green Dwarf (CGD)
8	New Guinea Green Dwarf (NGGD)
9	Sri Lanka Green Dwarf x Vanuatu Tall
10	WAT (as susceptible control)

The Rehabilitation Plantings

- **SGDxVTT:** High resistance of parents.
- Performance of hybrid under testing since 1995.
- No disease yet, but genetic analysis predicts low susceptibility to CSPWD and designated as a ‘promising hybrid’(Dery *et al*, 2008).
- Preliminary observations indicate it ‘promises’ to show good agronomic features (Dollet *et al*, 2006).
- **MYDxVTT:** Recommended for replanting due to past performance (1981/83 Dixcove Trials).
- Adaptive trials: to field testing resistance of hybrid.
- Results: CSPWD mortality estimated at 1%
- Inference: Suitable for replanting.

CSDP Replantings

- CSDP, Min of Agric, funded by AFD, has planted 1300ha, of 1025 farms, and 208000 palms, spread across 6 districts, in WR & CR, since 1999
- Results: CSPWD has been confirmed in 62 ha (4.8% of total area cropped). In terms of farms, 5.6% the farms have been affected by CSPWD.
- In terms of trees only 352 trees out of the total planted are affected (0.002%).
- An exceptional case of CSPWD mortality of 82% occurred at Elmina, KEEA (very unfavourable environmet).
- Inference: the hybrid succumbs under intense disease pressure; genetic analysis predicts 64% deaths.
- Redirection of replanting programme is essential

Discussion:

- **Prospects for rehabilitating the coconut industry:**
- Genetic modeling predictions for CSPWD mortalities:
  MYDxVTT=64%; SGDxVTT=37%;
- SGDxVTT has a better chance of surviving CSPWD
- **Acceptability**: Agronomic features promise to be acceptable (from preliminary observations)
- **Availability**: 10 ha and 5 ha SGD seedgardens at Bonsaso and Kade respectively.
- SGDxVTT planting capacity of 200-300 ha per year is achievable (Dollet *et al*, 2006).
- **Problem of VTT parent:** Sub-populations indicated by different fruit ‘colour-forms’.
- **Question:** are all ‘colour-forms’ equally resistant?

- **Solution to VTT Problem:**
- Each ‘colour-form’ crossed seperately with SGD and progeny planted in RCBD to test against CSPWD.
- **‘Diallel-Crosses’:** crossing the different ‘colour-forms’ among themselves will separate the VTT into ‘pure-lines’ of its subpopulations, which could then be screened for CSPWD resistance.
- **Environment of Coconut:** significant ‘genotypic and environmental effects’ on resistance of palms is reported (Ashburner and Been, 1995).
- Coconuts on poor soils only survive, but don’t thrive, and LY may be able to overcome resistance .
- **Integrated Disease Control recommended**: Resistant Varieties, good environment, good cultural practices.

New Replantings

- Scheme of Dollet *et al* (2006) and Dery *et al* (2008) recommended:
- **Fate of MYDxVTT:** to be used at ‘disease-free’ areas, where risk of infection is negligible or minimal.
- Within ‘endemic zones’: SGDxVTT could be used at devastated areas where disease has ‘passed’ and no diseased tree is in the vicinity.
- Areas near active disease foci must not be planted with coconut.
- In both cases good environment must be ensured: soil, location, climate, agronomic practice and sanitation

Resistant Screening Trials

- Necessary to continue screening: to identify more resistant varieties.
- More Cultivars from S. E. Asia: Genetic modeling analysis indicated that cultivars from S.E. Asia (Pacific group) were less susceptible than Indo-Atlantic ones (Dery *et al* 2008).
- Thus introductions of more cultivars from S.E. Asia recommended.
- Introduction of varieties genetically related to SGD
- Genetic analysis determined SGD and MRD as most resistant varieties so far (Dery *et al*, 2008): their hybrid ought to be tested for resistance.
- Use of microsatellite to identify ‘off-types’.

THANK YOU.